Chemical Reactions **Name**_____

Balancing Chemical Equations

Read from Lesson 1: Describing Chemical Reactions in the Chemistry Tutorial Section, Chapter 8 of The Physics Classroom:
Part a: What is a Chemical Reaction? Part b: Chemical Equations Part c: Balanced Chemical Equations

Part 1: Reaction Basics

1. Fill in the symbols or definitions on the following table:

Symbol	Meaning
O_2	
coefficient	_____ used to balance equations
→	"_____;" separates reactants and products
+	"_____;" separates multiple reactants or products
(g)	
(l)	
(s) or (ppt)	
(aq)	_____ – dissolved in water (homogeneous solution)

2. Write the skeleton equation for each reaction – this means proper formulae and states of matter, but no coefficients.
   a. When solid sodium hydroxide is added to a solution of hydrochloric acid, aqueous sodium chloride and liquid water are formed.

   b. Silver nitrate solution reacts with a solution of sodium chloride to form sodium nitrate solution and solid silver chloride.

   c. Solid sodium is added to liquid water and reacts to form aqueous sodium hydroxide and hydrogen gas.

3. In the following reaction, count how many atoms of each element are on the reactant side and product side:

$$\mathbf{3Ca(OH)_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6H_2O}$$

Element	Number of Atoms on Reactant Side	Number of Atoms on Product Side
Ca		
O		
H		
P		

Is this chemical equation balanced?

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Part 2: Balancing Chemical Equations

A chemical equation is balanced when the amount of each element on the reactants side is equal to the amount of each element on the products side. This is done to satisfy the Law of Conservation of Mass. It is a chemistry commandment that when you balance an equation: change coefficients but **never** change the subscripts!

For the following equations: first, write the skeleton equation with the correct formulae. Then balance the equations. (Hint: balance oxygen atoms last.) Show your work on a separate sheet of paper so you can do an atom count to demonstrate that the equation is balanced.

1. Solid aluminum reacts with oxygen gas to produce solid aluminum oxide.

2. Solid sodium carbonate reacts with aqueous acetic acid to form a solution of sodium acetate, liquid water, and carbon dioxide gas.

3. Iron metal reacts with chloride gas to produce solid iron (III) chloride.

4. A solution of hydrogen peroxide decomposes into liquid water and oxygen gas.

5. Solid potassium chlorate is heated to produce oxygen gas and solid potassium chloride.

6. Solutions of ammonium carbonate and magnesium sulfate react to form aqueous ammonium sulfate and a magnesium carbonate precipitate.

7. Butane (C_4H_{10}) gas reacts with oxygen gas to produce carbon dioxide gas and water vapor.

8. An iron nail is placed into a solution of copper (II) sulfate to produce solid copper and aqueous iron (III) sulfate.

9. Lithium hydroxide solution is combined with phosphoric acid solution to produce liquid water and aqueous lithium phosphate.

10. Solid ammonium nitrate decomposes into nitrogen gas, oxygen gas, and water vapor.

11. Solutions of aluminum nitrate and sodium hydroxide react to produce an aluminum hydroxide precipitate and aqueous sodium nitrate.

12. Octane (C_8H_{18}) liquid reacts with oxygen gas to produce carbon dioxide gas and water vapor.

13. Solid diphosphorus pentoxide reacts with solid calcium oxide to produce solid calcium phosphate.

14. Solid magnesium hydroxide decomposes into solid magnesium oxide and water vapor.

15. Solid iron (III) oxide reacts with liquid carbon tetrachloride to produce solid iron (III) chloride, carbon dioxide gas, and chlorine gas.